REMARKS

Applicants' counsel thanks Examiner Vo for her careful and thorough examination of the present application.

Claims 1, 4-7, 11, 13, 16-24, and 27-29 have been amended, and claims 10, 12 and 14-15 have been canceled without prejudice. New claims 30 and 31 have been added. No new matter has been entered. The substance of claims 10 and 15 has been incorporated into claim 1.

As amended, claim 1 recites a protective layer comprising a "*viscoelastic* foam substrate and a skin at least partially enclosing said foam substrate...." The "viscoelastic" limitation, previously found in claim 15, was rejected by the Examiner as being anticipated by each of Donzis and Krent. The Examiner's position is that both Donzis and Krent disclose foams having densities within or overlapping density ranges reported or claimed in the present application, and that if two foams have the same density and one is a viscoelastic foam, then the other also must be a viscoelastic foam.

With respect, the Examiner's reasoning is incorrect because it implied a fixed linear relationship between viscoelasticity and density which simply does not exist. It is believed this incorrect reasoning stems from a misunderstanding of what it means to be a *viscoelastic* foam, as opposed to an elastic (sometimes called "resilient") foam. For the Examiner's convenience, a brief description of *viscoelastic* foams is presented to aid in understanding the present claims.

Brief Description of Viscoelastic Foams

Viscoelastic foams are a class of foams that exhibit aspects of both viscous and elastic character. In order to fully appreciate viscoelastic foams, it is first necessary to provide a brief discussion of purely elastic and purely viscous foams.

For a purely elastic foam, all the energy of loading or compression (i.e. the energy required to compress or deflect the foam) is stored in its compressed or deflected state, and is returned by the foam once the load has been removed. Another way to think of it is that the foam essentially pushes back with the same force (equal and opposite) that is acting against and tending to compress it, and it continues to push back, even under static conditions, with the same force until the load is removed. The

displacement of an elastic foam exhibits an immediate (non-time dependent) response in phase with the load or strain.

Conversely, for a purely viscous foam, no energy is returned after the load tending to compress the sample is removed. More simply, a purely viscous foam does not "push back" against the loading stress except to the extent based on the foam's "rigidity" (described below). In other words, a viscous foam does not exert any rebound force against compression under static conditions (i.e., once the object supplying the compression force has come to a stop in contact with the compressed foam). Instead, all the energy imparted to the foam to compress it is converted into internal energy or heat based on internal frictional losses from the viscosity of the foam material.

All foams that are neither purely elastic nor purely viscous are classified as "*viscoelastic*" foams. In a viscoelastic foam, some of the loading energy (stress) from an external impact is returned by the foam following removal of the external load, and the remainder is dissipated through conversion to internal energy or heat from internal frictional losses based on the material's viscosity. The proportion of the loading energy (stress) that is lost in this fashion, and not returned by the foam, is called hysteresis. A typical hysteresis loss for a viscoelastic foam is greater than 60%, and can be as high as 80% or more, of the loading energy.

Thus, it will be seen that viscoelastic foams are deformable or deflectable based on an impact or compression event, but there is little or no permanent deformation once the external stress or force causing the deflection is removed. However, the rate of recovery of viscoelastic foams is not instantaneous and includes a time dependent component based on the foam's unique morphology. In simpler terms, there is a prolonged or extended process of recovery after the external compression or impact load has been removed, the duration of which is based on the foam's morphology, which is determined based on its unique composition.

From the foregoing, it should be evident that "viscoelasticity" refers to the manner and mechanism through which a foam stores and/or dissipates the energy required for compression, and a *viscoelastic foam* as now claimed returns a portion of the energy of compression and dissipates as heat another portion of that energy based on the

particular foam's hysteresis function, which in turn depends on the foam's specific morphology and composition.

It is important to distinguish the viscoelasticity of a foam from its rigidity. Although the degree of rigidity of a foam is related to the viscoelasticity, it is still an independent property and the two must not be confused. As noted above, viscoelasticity refers to the manner in which a foam stores and dissipates compression energy. On the other hand, rigidity is a measure of the foam's static hardness, sometimes called its "durometer" or modulus. More specifically, rigidity refers to a foam's qualitative hardness or resistance to deflection based on an external load. Thus it will be seen that the former (viscoelasticity) relates to how the foam stores and dissipates energy, largely governing the rate of recovery after impact, whereas the latter (rigidity) relates to how hard it was to deflect or compress the foam in the first place.

It is safe to say that if the chemical compositions of two separate foams are not *precisely identical*, then the resulting foams will have different physical properties. Two foams may have the same density based on mass per volume, but nonetheless differ in their degree of rigidity and/or viscoelasticity based on the unique composition of each foam. For example, although all viscoelastic foams share the common the characteristic that they exhibit delayed recovery (high hysteresis) during a compression cycle, unless the two viscoelastic foams are of *identical* composition they can vary widely and unpredictably in terms of virtually all other physical properties, e.g., flexibility/rigidity, ***density***, etc.

Thus, it will now be appreciated that there can be prepared a variety of different classes of foams, including:

- semi-rigid viscoelastic foam;
- semi-rigid elastic (resilient) foam;
- flexible viscoelastic foam;
- flexible elastic (resilient) foam;
- rigid viscoelastic foam; and, in principal,
- rigid elastic (resilient) foam, although this latter class would be rare.

Note also that foams can be prepared in each of these classes having a range of densities, and that density does not fix the elastic or viscoelastic character of a particular foam.

Response to Rejections

With the above background in view, the claim rejections will now be addressed.

The error in the Examiner's prior reasoning should now be evident. It is incorrect to say that a prior art foam must be a viscoelastic foam as claimed simply because the two foams have comparable density. Indeed, it is noted that claim 16 depends from claim 1 which already recites a "viscoelastic foam," and further limits the foam to having a density of 104 kg/m^3. Were density itself a measure of viscoelasticity, then the foam's density would be inherent in claim 1 and the further recitation of density in a dependent claim would be redundant. Of course, density *is not* inherent in claim 1 because to say the foam therein is a "viscoelastic foam" bears no *per se* relationship to the foam's density.

Therefore, based on a correct understanding of viscoelasticity, it is evident that neither Donzis nor Krent discloses a viscoelastic foam as recited in claim 1. The Examiner has implicitly acknowledged this shortcoming in both these references by turning to a third reference, Dera, to imply viscoelasticity based on the density of the foams reported in Donzis and Krent. However, because there is no *per se* relationship between viscoelasticity and density, it is now clear that the rejection was improper. Accordingly, it is respectfully submitted that the rejections of claim 1 have been overcome.

The Examiner also has rejected claim 9 as being anticipated by each of Donzis and Krent. Claim 9 ultimately depends from claim 1 and further limits the viscoelastic foam of that claim to being "semi-rigid." New claim 30 presents a similar limitation to claim 1 but without the "open-cell" limitation of intervening claim 7. The Examiner's basis of rejection for this claim also relies on comparison of foam densities between the present application and the prior art. Specifically, the Examiner notes that Donzis discloses foams having similar or overlapping densities as in the present application

and argues that this is conclusive evidence that the foam of the prior art, therefore, must also be semi-rigid as claimed.

First, it is noted that nowhere in the present application is the degree of rigidity of a foam (i.e. "semi-rigid") equated directly to foam density. Referring to the claims, claim 16 depends from claim 1 and specifies a density range, and claims 9 and 30 separately depend from claim 1 and specify the foam is "semi-rigid." Further, looking through the specification, there is no basis to presume that density and foam rigidity are *per se* related. Indeed, while density may be one factor contributing to the overall rigidity of a foam, it is not the only factor; certainly it is not the dispositive factor, and a foam's rigidity (or "semi-rigidity") will depend heavily on the foam's unique chemical structure and morphology. Therefore, it is wrong to say that a prior art foam must be semi-rigid simply because it may share or overlap with a density range for a foam of the present application.

This fact is most clearly illustrated directly from the Examiner's own characterization of one of the applied references, Krent, in view of a further reference, Dera. At page 4 of the Office action, the Examiner states:

> The foam substrate [in Krent] is a flexible, open cell polyurethane foam having a density from 2 to 4 lb/ft^3 (column 7, lines 7-8). Dera evidences that the semi-rigid polyurethane foam having a density of 2 to 7 lb/ft^3 (column 1 lines 46-47). Therefore, the flexible open cell polyurethane foam disclosed by Krent is also a semi-rigid open cell polyurethane foam.

Indeed, Dera does disclose a "semi-rigid polyurethane foam of density between 30 and 120 g/dm^3," which equates to 1.87-7.5 lb/ft^3, or about "2 to 7 lb/ft^3" as noted by the Examiner. However, this does not mean that foams in this density range always are "semi-rigid" as the Examiner's argument implies. Instead, what the Examiner has found is direct proof that two foams can be of the same or similar density and yet be vastly different in terms of their rigidity. From the passage cited by the Examiner, the foam in Krent has a density of 2-4 lb/ft^3 and is a "flexible"[1] polyurethane foam. Meanwhile, the foam in Dera has the same or similar density (2-7 lb/ft^3), yet it is a "semi-rigid"

[1] Krent at col. 7 lines 7-8 cited by the Examiner describes "an open cell ***flexible*** polyurethane foam [that] typically has a density of about 2-4 pounds per cubic foot."

polyurethane foam. The Examiner attempted to reconcile these contrary teachings in the cited references simply by concluding that "the flexible...foam disclosed by Krent is also a semi-rigid...foam." Office action, page 4.

This makes no sense. "Flexible" and "semi-rigid" are different classes of rigidity. A foam is either flexible, semi-rigid or rigid based on its chemical composition and the resulting morphology. Thus, the Examiner's own example proves that two different foams can have the same or similar density, yet differ in other physical properties, including rigidity.

Returning to the rejection of claim 9, just because a prior art reference may describe a foam having the same or similar density as a foam described or claimed in the present application, this does not imply the foam in the prior art must have the same rigidity as claimed. Accordingly, it is respectfully submitted the rejection of claim 9 has been overcome.

The Examiner also has rejected claims 2 and 3 citing a similar inherency argument as above, namely that "since [Donzis -- page 3 of Office action, or Krent -- page 4] uses the same material to form the substrate as Applicants, it is not seen that the glass transition temperature could have been outside the claimed range." Respectfully, this is incorrect reasoning. It is not apparent that the references are using precisely the same composition as the applicants, and except to note similarities in foam density, the Examiner has presented no evidence of the identity of the foam compositions. Accordingly, the rejections of claims 2 and 3 also are believed to be overcome.

The Examiner also has rejected claim 11 as being anticipated by each of Donzis and Krent. Claim 11 has been amended to require that the protective layer is more rigid adjacent the first protective zone than adjacent the second protective zone "by virtue of the relative size and/or density of vent holes provided in said first protective zone compared to in said second protective zone." Essentially, in claim 11 the protective layer has at least two zones of different rigidity based on the size and/or density (number per area) of vent holes provided through the skin in each of the zones. Neither of the cited reference discloses such a structure, having two protective zones, each having a different rigidity based on a different number of or different sized vent holes in

each zone. Accordingly, it is believed the rejections of claim 11 also have been overcome.

In summary, the rejections of claims 1, 2-3, 9 and 11 all have been overcome, and thus are respectfully submitted as being allowable. All remaining claims are dependent claims and are believed also to be allowable as such.

If any additional fees are required by this communication, please charge the same to our Deposit Account No. 160820, Order No. 34563US1.

Respectfully submitted,

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